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The Mexican cavernicolous *Pseudosinella* (Collembola: Entomobryidae) with description of a new species

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ABSTRACT
A compilation of the information on the genus *Pseudosinella* from Mexican caves was undertaken and one new species from Puebla State is described and illustrated: *P. rochezi*, sp. nov. It is similar to *P. bonita* Christiansen, 1973 and displays typical troglomorphic characters. An identification key for all Mexican cave species of the genus is presented.

Key words: Cave fauna, *Pseudosinella*, identification key, México, new taxa

INRODUCTION

Pseudosinella is one of the most diverse genera of springtails with about 330 species (Bellinger et al 1996-2010). Members of the genus are found in all countries and in many diverse habitats, including soil, litter, on vegetation and in caves.

Eighteen species of the genus, including the new one described below, have been recorded from Mexican caves. However, some remain undescribed (sp. BB and sp QQ of Christiansen, 1982). The most important contributions to the taxonomy of the cavernicolous members of the genus in Mexico were made by Christiansen (1973, 1982) and Christiansen and Reddell (1986). One recent key for the identification of these species was prepared and is given here.

Those species with troglomorphisms are usually big in comparison with those living in soil and litter or even with those living in caves but without strong adaptations to cave life (Table 1). Here we describe a new taxon showing interesting morphologic characters, which are a clear indication of adaptation to cave life. (Table 1).

For description of the new species and construction of keys, we used the system of Gisin (1967) and the formula of Christiansen et al. (1990). In keeping the same system we use the same abbreviations as those in our recent contribution to the genus (Simón Benito and Palacios-Vargas 2007). Also, we use the keys posted on the web page of Christiansen (2007).

SPECIES DESCRIPTION

Pseudosinella rochezi, sp. nov.
(Figs 1-6, 7-11, Table 2)

Material examined.

Mexico, State of Puebla, karst region of Tzontezecuiculi, in one small cave close to Tepepan Zaragoza, 19.II.2002. (GPS TZ 22 coordinates 14 Q 0720429 UTM 2038732, 1,450 m elevation. - 1 male (holotype) found in decomposing tree trunk.

Etymology.

This species is named after Mr. Gaëtan Rochez, who collected the specimen.

Description. Length 2.45 mm. Body without pigment, 0+0 eyes.

Antenna without pigment or scales, and 3.6 times longer than head. Ant. IV without a clear apical bulb. Ratio of antennal segments as 1: 1.6; 3.0; 4.0 (Fig. 1). Apical organ of third antennal segment with two straight short rods, difficult to observe (Fig. 2). Head with macrosetae R0, R1, R2, S and T; and Po macroseta absent (Fig. 3). Four triangular labral papillae. Differentiated setae of outer labial papilla (E) straight and its apex not reaching the apex of papilla, with 3 sublobular setae on the external maxillar lobule. Labial triangle formula: M_1, M_2, r, E, L_1, L_2 (Fig. 4), all smooth. Five ciliated setae along the head ventral groove.

Mesothorax slightly protuded, pushing head into small hypognathus position. Legs without scales, tibiotarsus with ciliate and acuminate macrosetae, and also with some differentiated setae. Tenent hair acuminate and shorter than the internal length of ungues (ungues 3.6 times as long as tenent hair). Unguis long and slender, with two inner teeth; basal pair smaller, distal tooth located about 10 % of the internal side of unguis; distal unpaired tooth located about 17 % the internal side of unguis; lateral and outer tooth absent (Fig. 5). Unguiculus smooth, lanceolate, basally swollen and about the length of unguis (unguis is 1.3 times the length of unguiculus).

Dorsal macrosetae formula: R110/00/0101+2. Chaetotaxy of Abd. II: apBq_1q_2, setae "a" fan-like shaped ciliate (Fig. 7). Bothriotrical complex on Abd. IV without accesory seta "s" (Fig. 8).

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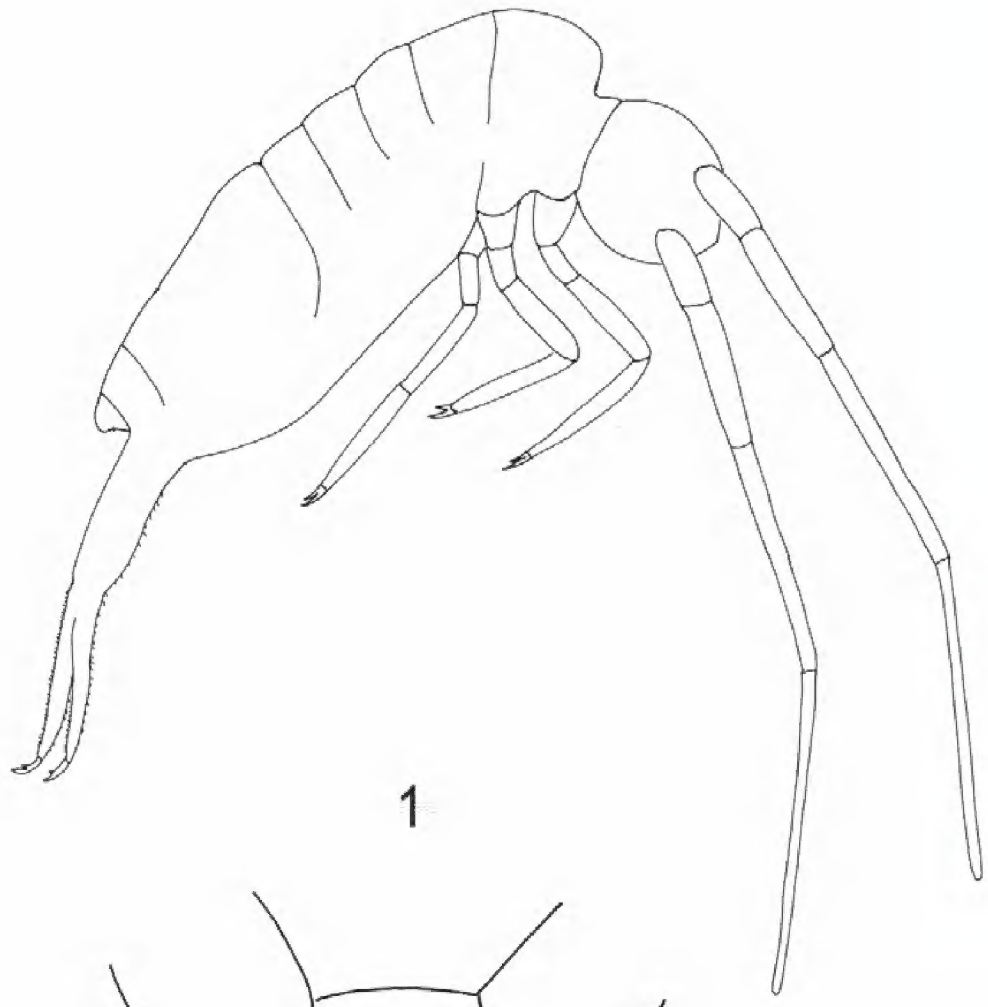

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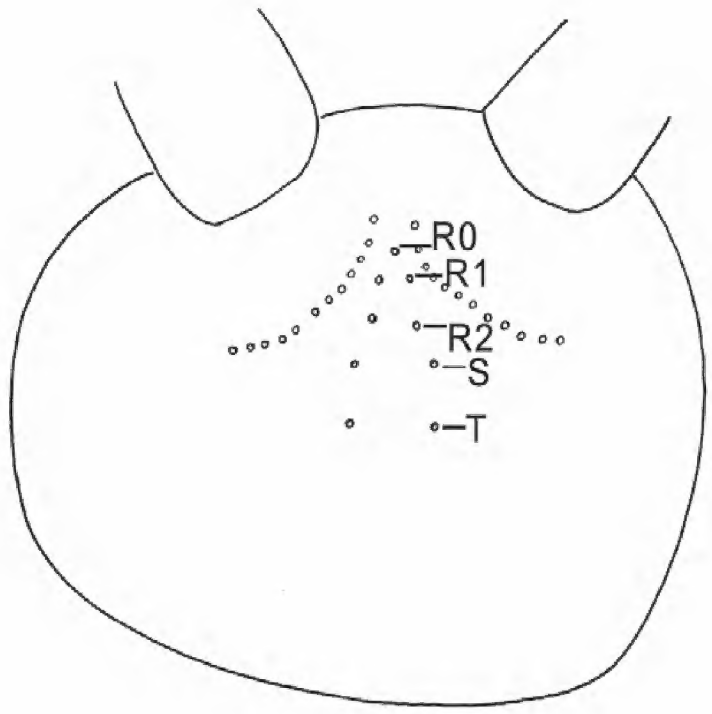

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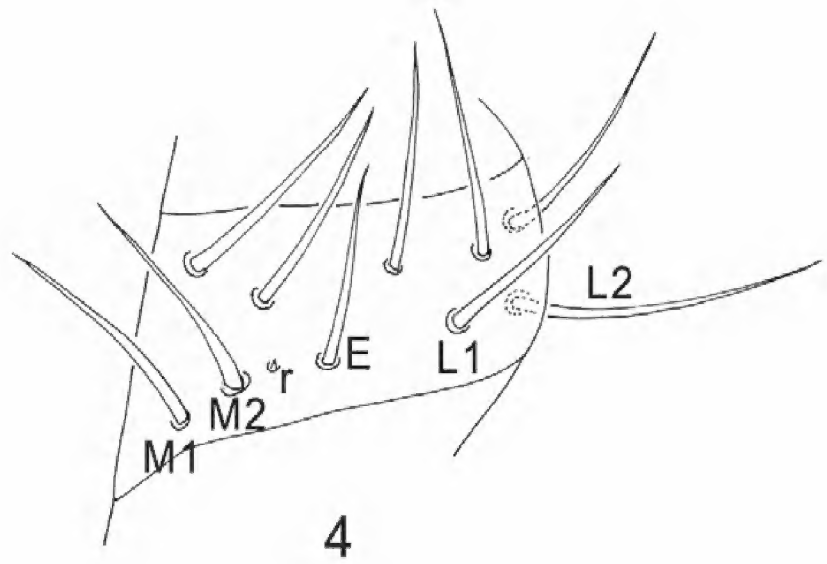

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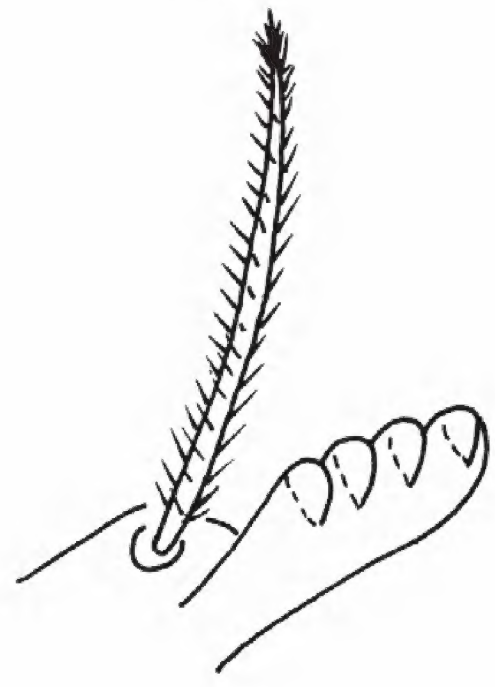

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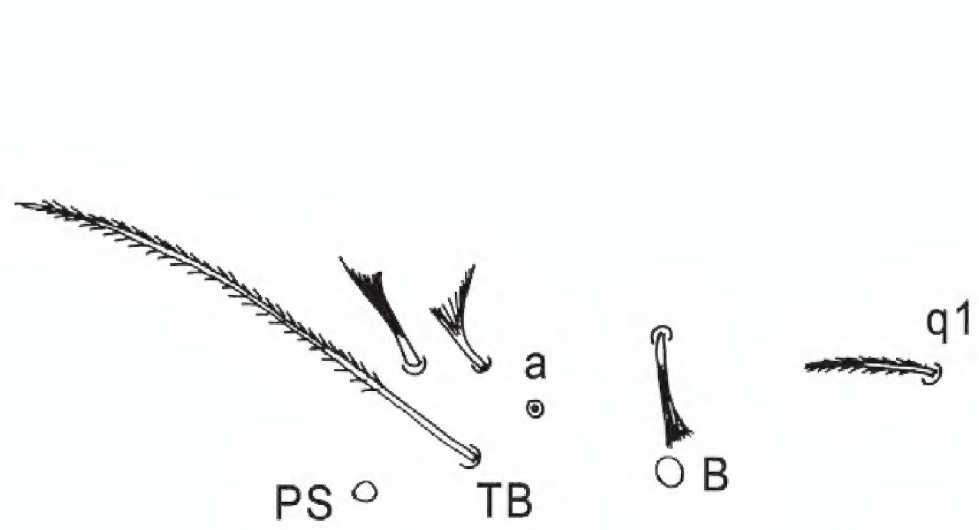
Figs 1-6 - *Pseudosinella rochezi*, sp. nov.: 1, habitus; 2, sensorial organ of Ant. III; 3, head chaetotaxy; 4, labial triangle; 5, foot III complex; 6, half retinaculum lateral view.



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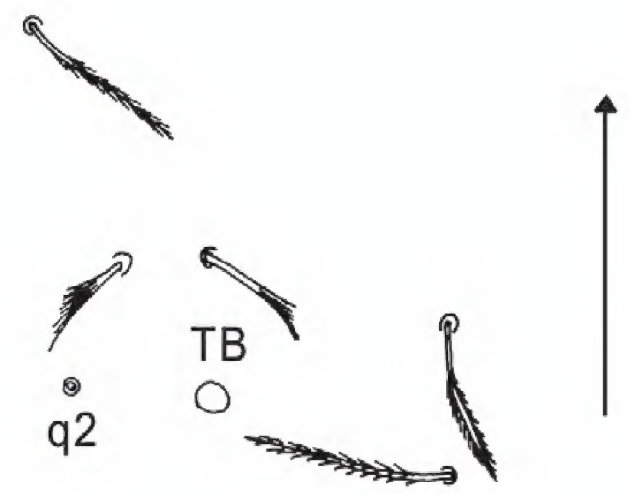

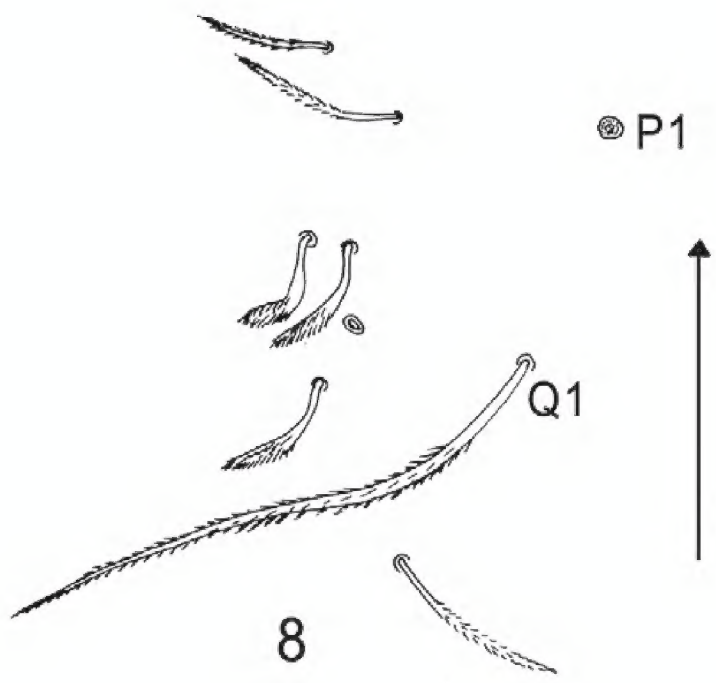

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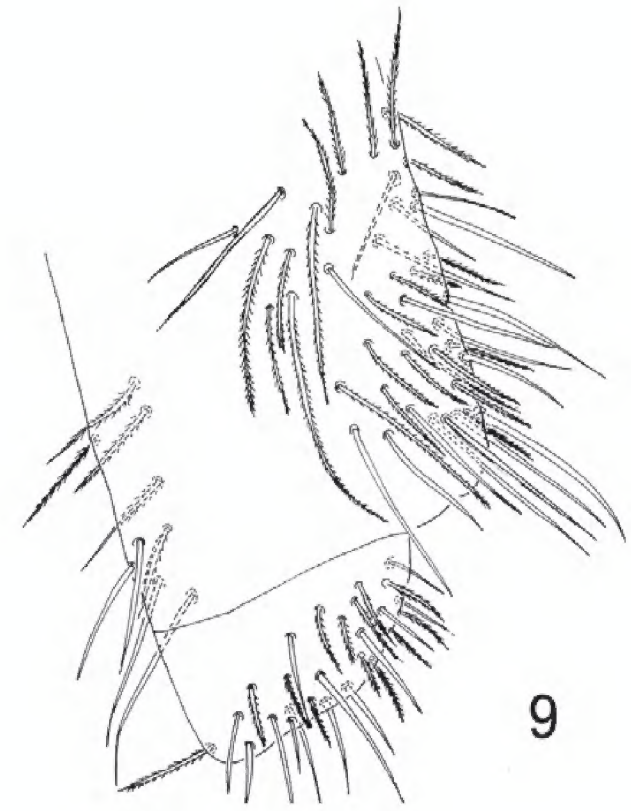

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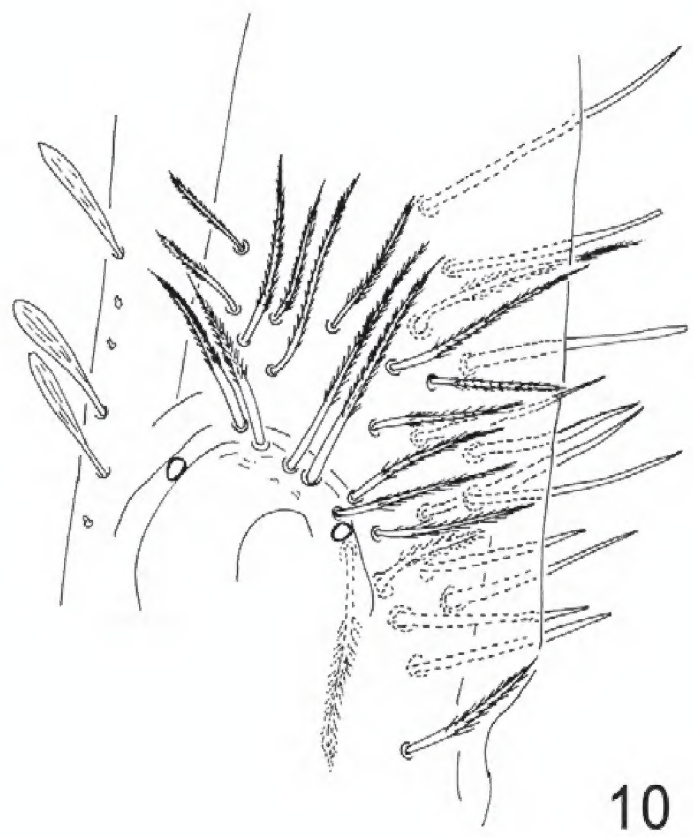

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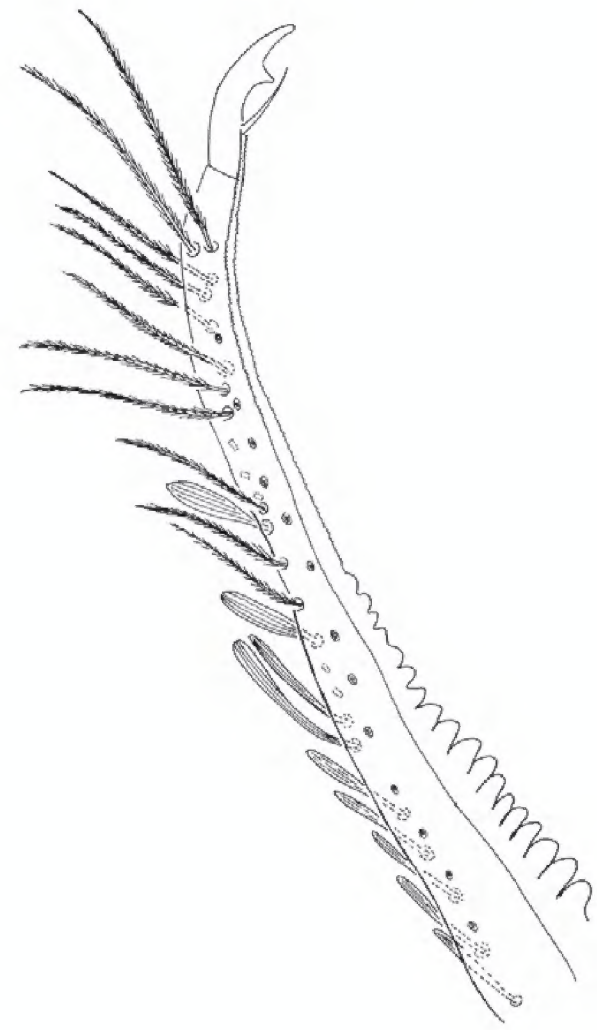

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Figs 7-11 - *Pseudosinella rochezi*, sp. nov.: 7, chaetotaxy of anterior bothriotrichal complex of Abd. II; 8, bothriotrichal complex of Abd. IV; 9, ventral tube in lateral view; 10, distal part of manubrium and basal part of dens; 11, distal part of dens and mucro.

Table 1 - Comparison of size and habitat distribution among the different species of *Pseudosinella* found in Mexican caves.

	Locality	**Biotope**	**Maximal size in mm**
P. violenta (Folsom, 1924)	Durango, Chihuahua, Coahuila	Soil and litter	2.1
P. sp. QQ	Mexico, Central America, West Indias	Cave	1.2
P. petrustrinatii Christiansen, 1982	Guerrero, San Luis Potosi, Tamaulipas	Cave	?
P. cava Christiansen & Reddell, 1986	Hidalgo, San Luis Potosí, Querétaro	Cave	1.5
P. finca Christiansen, 1973	Puebla, Oaxaca, Morelos. Guatemala: Verapaz	Cave	1.8
P. palaciosi Christiansen & Reddell, 1986	Guerrero	Cave	0.8
P. hautla Christiansen, 1982	Oaxaca	Cave	2.0
P. bonita Christiansen, 1973	Oaxaca	Cave	3.6
P. crypta Christiansen & Reddell, 1986	Sierra Madre Oriental	Potrero Redondo	3.0
P. yuca Christiansen, 1982	Yucatán	Cenote	0.8
P. reddelli Christiansen, 1973	Nuevo León, San Luis Potosí, Coahuila, Tamaulipas	Cave	2.5 - 3.1
P. leoni Christiansen, 1982	Nuevo León, Oaxaca	Cave, Guano	2.5
P. sp. BB	México (country)	Litter	1.1
P. vera Christiansen, 1982	San Luis Potosí, Puebla, Veracruz	Cave	1.7
P. voylesi Christiansen, 1982	Puebla	Cave	3.08
P. volca Christiansen, 1982	Veracruz	Cave	1.8
P. rochezi, sp. nov.	Puebla	Cave	2.4
P. strinatii Christiansen, 1973	San Luis Potosí, Tamaulipas	Cave	1.6

Ventral tube with 12+12 barbulate distal setae and 10+10 smooth distal setae and 5+5 in the posterior medial region (Fig. 9). Retinaculum with 4+4 teeth and one barbulate seta (Fig. 6). Distal part of manubrium dorsally with 2-3 internal and 3-4 external setae separated by 2 pseudopores (Fig. 10). Dentes basally with long and smooth spine-like setae (Fig. 10). Mucro bidentate, mucronal spine smooth (Fig. 11).

DISCUSSION

Pseudosinella rochezi, sp. nov. is similar to the Mexican cave species *P. vera*, *P. huautla*, *P. volca* and *P. bonita* in the habitus and the unusual elongation of antennal segment IV. Similarities and differences of the five species are shown in Table 2. The new species most closely resembles *P. bonita* (3.6 mm) but the two species differ in size (*P. rochezi* sp. nov. is 2.4 mm), and in addition the new species has dorsal head macroseta T and the smooth microseta r. For the number of inner and outer setae of manubrial setae of manubrial plate, it is more similar to *P. vera*. Dens in *P. bonita* has small spines, in *P. rochezi*, sp. nov. they are longer. The anntenal/cephalic diagonal in the new species is 3.7, more similar to *P. huautla*. The apical organ of third antennal segment is rod-like, differing from all other Mexican cave species. *P. rochezi*, sp. nov. was found in one cave in Puebla state and *P. bonita* was found in three caves in neighboring Oaxaca state (Table 1).

Key to Mexican species of *Pseudosinella*.

1 Unguiculus with a winged tooth..... *P. violenta*
- Unguiculus without a winged tooth 2
2 Base of dens with short spines 3
- Base of dens without short spines 4
3 Unguis thin with three internal teeth.....*P. crypta*
- Unguis with less than three internal teeth 19
4 Tenent hair capitate 5
- Tenent hair acuminate 12
5 Eyes present..... 6
- Eyes absent..... 9
6 Five eyes per side.....*P.* sp. QQ
- Three eyes per side..... *7*

Table 2 - Comparison of characters of *P. rochezi*, sp. nov. with those of the closest species. Number in parenthesis is the character state proposed by Christiansen (2007).

	vera	***hautla***	***volca***	***bonita***	***rochezi*, sp. nov.**
1. dorsal cephalic macrosetae S	absent (1)	absent (1)	absent (1)	present (2)	present (2)
2. dorsal cephalic macrosetae T	absent (1)	present (2)	present (2)	absent (1)	present (2)
3. Labial m1	smooth macroseta (3)	smooth macroseta (3)	smooth macroseta (3)	smooth macroseta (3)	smooth macroseta (3)
4. Labial m2	smooth macroseta (3)	smooth macroseta (3)	smooth macroseta (3)	smooth macroseta (3)	smooth macroseta (3)
5. r (ventral labial)	absent (5)	absent (5)	smooth microsetae (1)	smooth microseta (1)	smooth microsetae (1)
6. e (ventral labial)	smooth macrosetae (3)	smooth macrosetae (3)	smooth macrosetae (3)	smooth macrosetae (3)	smooth macrosetae (3)
7. L1 (ventral labial)	smooth macrosetae (3)	smooth macrosetae (3)	smooth macrosetae (3)	smooth macrosetae (3)	smooth macrosetae (3)
8. L2 (ventral labial)	smooth macrosetae (3)	smooth macrosetae (3)	smooth macrosetae (3)	smooth macrosetae (3)	smooth macrosetae (3)
9.a (second abd seta)	smooth macrosaeta (3)	smooth macrosetae (3)	smooth macrosetae (3)	smooth macrosaeta (3)	ciliate microseta (2)
10.b (second abd seta)	smooth macrosaeta (3)	smooth macrosetae (3)	smooth macrosetae (3)	smooth macrosetae (3)	ciliated macrosetae (4)
11. p (second abd seta)	absent (1)	absent (1)	absent (1)	absent (1)	absent (1)
12. q1 (second abd seta)	smooth microsetae (1)	smooth microsetae (1)	smooth macrosetae (1)	smooth microsetae (1)	smooth microseta?
13. q2 (second abd seta)	smooth microsaeta (1)	smooth microsaeta (1)	smooth microsaeta (1)	smooth microsaeta (1)	smooth microseta?
14. posterior thoracic seg 2 macrosetae	clavate (2)	truncate (3)	(?)	absent (4)	absent (4)
15. posterior thoracic seg 2 macrosetae	1 (one)	2 (two)	1 (one)	0 (zero)	0 (zero)
16. thoracic seg 3 macrosetaee	absent (3)	(?)	absent (3)	absent (3)	absent (3)
18. anterior lateral(P) fourth abdominal dorsal macrosetaee	1(2)	1(2)	1(2)	1(2)	1(2)
19. median (M) 4th abd dorsal macrosetaee	2(2)	2(2)	2(2)	2(2)	2(1) ?
20. supplementary seta (4th abd seg)	present (2)	present (2)	present (2)	present (2)	absent (1)
21. tenent hair shape	acuminate (1)	acuminate (1)	acuminate (1)	acuminate (1)	acuminate (1)
22. number of teeth of inner unguis	3(2)	3(2)	3(2)	1(2)	2(1)
23. ungual wing tooth	present (2)	absent (1)	absent (1)	absent (1)	absent (1)
24. unquiculus wing tooth	absent (1)	minute (2)	absent (1)	absent (1)	absent (1)
25. unguiculus shape	acuminate (1)	acuminate (1)	acuminate (1) basally swollen (3)	basally swollen (3)	basally swollen (3)
26. number of eyes per side	0-2(zero-three)	0 (zero)	0 (zero)	0 (zero)	0 (zero)

27. inner setae manubrial plate	2(2)	2-3(2-3)	3(3)	3(3)	2(2)
28. no. outer setae manubrial plate	3 (4-6)	range: 2 (2-6)	5(5)	6-10	4(four)
29. habitat	cave (1)	cave (1)	cave (1)	cave (1)	cave (1)
30. region located	mexico (3)	mexico (3)	mexico (3)	mexico (3)	mexico (3)
31. apical antennal bulb	absent (1)	absent (1)	absent (1)	absent (1)	absent (1)
32. apical organ of third antennal segment	expanded (2)	expanded (2)	expanded (2)	paddle-shaped (3)	peg or rod-like (1)
33. maximum length	1.7 mm.	2 mm.	1.8 mm.	3.6 mm	2.4 mm
34. distance distal unpaired ungual tooth from base total unguis %	55 %	?	?	17%	0.15 %
35. antennal cephalic diagonal	1.3	3.5	2.5	4.5	3.7
36. differentiated inner seta on hind tibiotarsus	not applicable	clear acuminate (1)	clear ? acuminate (1)	?	clear acuminate (2)
37. cephalic seta R0	(?)	present (2)	present (2)	present (2)	absent (1)
38. cephalic seta R1	present (2)	present (2)	present (2)	present (2)	present (2)
39. cephalic seta R2	present (2)	present (2)	present (2)	present (2)	present (2)
40. cephalic seta R3	absent (1)	absent (1)	absent (1)	absent (1)	absent (1)

7 Some basal setae of the labial triangle barbulate ..... *P. yuca*
- All labial setae smooth 8

8 Unguis with a basal tooth longer than the other ..... *P. vera*
- Ungual teeth subequal ..... *P. reddelli*

9 Abdominal segment IV with 0 + 2 macrosetae ..... *P. petrustrinatii*
- Abdominal segment IV with 1 + 2 macrosetae 10

10 Head macrosetae S and/or T present 11
- Head macrosetae S and T absent ..... *P. leoni*

11 Both head macrosetae S and T present ..... *P. cava*
- Head macroseta S absent (=Only T present?) ..... *P.* sp. BB

12 Eyes present 13
- Eyes absent 16

13 Unguis with a basal tooth longer than the other 14
- Ungual teeth subequal 15

14 Head macrosetae S or T present ..... *P. finca*
- Head macrosetae S or T absent ..... *P. vera*

15 With 2 + 2 eyes, separated ..... *P. palaciosi*
- With 1 + 1 or 2 + 2 eyes, very close to each other ..... *P. voylesi*

16 Head macrosetae S and T absent ..... *P. vera*
- Head macrosetae S or T present 17

17 Abdominal segment IV with 0 + 2 macrosetae ..... *P. volca*
- Abdominal segment IV with 1 + 2 macrosetae 18

18 Antenna less than 2.4 times the cephalic diagonal ..... *P. finca*
- Antenna more than 2.5 times the cephalic diagonal ..... *P. hautla*

19 Adult 2.4 mm long, labial r seta present as smooth microseta, basal dental spines long ..... *P. rochezi*, sp. nov.
- Adult 3.6 mm long, labial r seta absent, basal dental spines short ..... *P. bonita*

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